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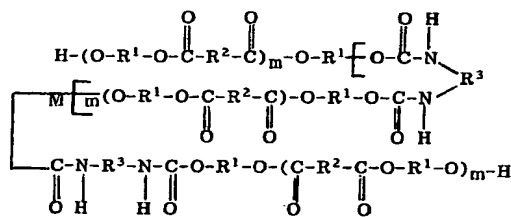
93-322458/41 A23 (A25) SHOP 92.04.10
 SHOWA HIGH POLYMER CO LTD *EP 565235-A2
 92.04.10 92JP-091118 (93.10.13) C08G 18/42, 18/73, 18/75
 Saturated aliphatic polyester containing a small number of urethane bonds -
 has excellent heat stability, strength and mouldability, and is
 biodegradable (Eng)
 C93-143358 R(DEFR GB IT)
 Addnl. Data: TAKIYAMA E, NIKURA I, SEKI S, FUJIMAKI T
 93.03.08 93EP-301710

A saturated aliphatic polyester containing urethane bonds, M_n at least 10000 - at least 30000, M_w/M_n at least 2.5, viscosity at least 10 poise (10% in o-chlorophenol, 25°C), and m.pt. at least 60°C has formula (I):

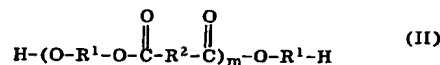
R^1, R^2 = straight chain alkylene $-(CH_2CH_2)_p-$ and $-(CH_2CH_2)_q-$
 p, q = integer 1-5;
 R^3 = diisocyanate residue;
 m = as below; and
 M = 0 or at least 1.

The polyester is obtained by reaction of a polyesterdiol with M_n at least 5000, M_w at least 15000, M_w/M_n at least 2.5, of formula (II) and a diisocyanate

A(5-G2, 9-A, 10-E24)



(I)



m = number average degree of polymerization.

MORE SPECIFICALLY

p, q = 1 or 2;
 R^1, R^2 = different alkylene groups, esp.
 R^1 = tetramethylene group; and

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R^2 = ethylene group; and
 R^3 = alkylene or alicyclic group, esp. hexamethylene.

USE/ADVANTAGE

The polyester exhibits excellent heat stability, strength and mouldability, and is biodegradable. It can be formed easily, without gelation problems, by adding diisocyanate to molten polyesterdiol.

PREFERRED POLYESTER

The polyesterdiol is obtained by reaction of ethylene glycol or 1,4-butanediol with succinic acid (anhydride), and has M_n at least 10000, M_w at least 30000, and M_w/M_n = 3.8. The polyester has M_n at least 20000 (20000-70000), M_w at least 100000 (100000-1000000), M_w/M_n at least 3 (3-8), m.pt. at least 90°C, and viscosity at least 100 poise (10% in o-chlorophenol, 25°C).

EXAMPLE

A mixture of (g) 1,4-butanediol (300), succinic acid (348) and dibutoxydiacetoacetoxyl Ti (0.13) was esterified at 200-205°C under N_2 to acid value 7.9. Glycol elimination was then performed at 210-215°C with the pressure finally reduced to 0.5 Torr to obtain a polyesterdiol with M_n 16600, M_w 41500, M_w/M_n 2.5, and m.pt. 115°C, being a white waxy polymer at room temp. due to crystallinity.

The polyesterdiol (540) was heated to 210°C and hexamethylene diisocyanate (7) added, the viscosity increasing rapidly without gelation. The polyester produced had small amounts of urethane bonds, M_n 32000, M_w 98000, M_w/M_n 3.1, corresponding to (I, $M = 0$). Viscosity was 233 poise (10% in o-chlorophenol, 25°C), m.pt. was 120°C and MFR 1.9 (JIS K 7210; 190°C; 2.16 kg). After melting at 190°C, the polyester was extruded and stretched at 4 x 2.5 times at 80°C into a transparent film, thickness 35-40 μ . The film was extremely tough and had lengthwise tensile strength 14.9 kg.cm². (22pp2235JSDwgNo0/8).

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